

Marine Mammal Systems in Support of Force Protection

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ABSTRACT

Multiple threat scenarios exist to high-value assets in U.S. ports, including threats from clandestine swimmers, divers, and small underwater vehicles. This paper reviews the Navy’s Marine Mammal Program port security and force protection capabilities and how these assets can be used to enhance the ability of security forces to detect and prosecute underwater threats.

INTRODUCTION

This paper reviews the Navy’s Marine Mammal Program port security and force protection capabilities and how these assets can be used to enhance the ability of security forces to detect and prosecute underwater threats. The Navy Explosive Ordnance Disposal forces operate and maintain the MK 6 Mod 1 anti-swimmer/diver marine mammal system (MMS). MK 6 is a dolphin-based system that uses Atlantic bottlenose dolphins to detect and mark underwater swimmers and divers in open-water areas such as ship channels and anchorages. SSC San Diego currently maintains a limited capability for demonstrating the Shallow Water Intruder Detection System (SWIDS). SWIDS uses California sea lions to detect and mark underwater intruders in the near-shore areas such as in and around piers.

Recently, dolphins and sea lions were deployed to Submarine Base (SUBASE) Kings Bay for a 30-day MMS port security demonstration. This deployment demonstrated the abilities of the animals to detect and mark a variety of underwater threats and MMS interoperability with the existing SUBASE Kings Bay security force structure. The results of the demonstration were very favorable and clearly demonstrated the ability of the animals to augment and enhance swimmer/diver detection and interdiction at SUBASE Kings Bay. Efforts are currently underway to re-deploy to SUBASE Kings Bay for an extended period to further qualify the value and viability of these systems to serve as a force multiplier for port security operations. Additionally, SWIDS, along with its SSC San Diego team, were most recently tasked to perform force protection and port security operations for naval assets in Bahrain as part of Operation Enduring Freedom.

Multiple threat scenarios exist to high-value assets in U.S. ports, including threats from clandestine swimmers, divers, and small underwater vehicles. This paper discusses the protection of those high-value assets using U.S. Navy MMS assets (MK 6 MMS and SWIDS), which can be applied as physical and waterfront security force protection enhancement assets as shown in Table 1.

TABLE 1. MMS asset security and intruder detection roles.

Task System	Sentry	Patrol/Intruder Response	Other Potential Missions
MK 6 MMS	Yes	Yes. Best suited for open-water patrol and response such as in ship channels and fleet anchorages.	Ship escort Hull searches
SWIDS	No	Yes. Best suited for near-shore areas such as in and around piers and wharves. Also capable of open-water work as described above.	Pier inspections

BACKGROUND

The Navy Marine Mammal Program began in 1959 with independent research programs at China Lake and Point Mugu supported by the Office of Naval Research. The Navy was interested in the hydrodynamics of the dolphin. Broader understanding of how dolphins move in the water was to be applied to improve torpedo, ship, and submarine designs. In 1965, in a program called Sealab II, a dolphin worked for the first time in the open ocean off La Jolla, CA, bringing tools and equipment from the sea surface to divers working 200 feet below. One of the successes of Sealab II was the realization that untethered marine mammals could do useful work in the open sea. The Navy soon realized that there were other open-ocean tasks that would be difficult or potentially hazardous to accomplish using humans or hardware, yet perfectly safe and readily achievable by trained marine mammals.

Sea lions were also found to have useful capabilities and successfully demonstrated the ability to dive and attach missile recovery hardware, allowing for missile retrieval. In 1967, the Advanced Marine Biological Systems (AMBS) program was established as the major research and development component of the Navy's program. The AMBS program explored the capabilities of marine mammals to do Navy tasks. This program also made advances in animal care, health, research, and management of the animals. The AMBS program, along with other acquisition efforts, eventually resulted in the successful introduction of the five MMS currently operational in the Fleet. Supported by fleet MMS, studies continue to further advance our knowledge of marine mammals. This knowledge will be used to enhance current systems and to develop new system capabilities.

OPERATIONAL FLEET SYSTEMS

In its operational fleet systems, the Navy employs dolphins and sea lions to find and mark the location of underwater objects. Dolphins are essential because their exceptional biological sonar is unmatched by hardware sonars in detecting objects in the water column and on the sea floor. Sea lions are used because they have very sensitive underwater directional hearing and low-light-level and turbid-water vision. Both of these marine mammal species are trainable for tasks and are capable of repetitive deep diving. Some of the objects the animals find are expensive to replace. Others could present a danger to Navy personnel, vessels, and facilities. Each MMS is designed for a specific job, but all of the animals work under the care and close supervision of their trainers/handlers. These human/animal teams can be deployed within 72 hours of notice and can be rapidly transported by aircraft, helicopter, and land vehicles with all necessary equipment to potential regional conflict or staging areas all over the world. They regularly participate in major fleet exercises.

Fleet MMS are currently assigned to Navy Explosive Ordnance Disposal Mobile Unit Three (EODMU THREE) and Naval Special Clearance Team ONE (NSCT ONE). Each system has a complement of marine mammals, an officer-in-charge, and several enlisted personnel. The animals are generally trained for a particular operational capability called a "system"; however, animals may be cross-trained to better serve the needs of the Fleet. SSC San Diego supports these fleet systems with replenishment marine mammals, hardware, training, personnel, and documentation.

MK 6 MOD 1 MMS

The MK 6 Mod 1 MMS is a rapidly deployable swimmer detection and marking system that uses dolphins to protect harbors, anchorages, and individual assets against unauthorized swimmers, scuba divers, closed-circuit divers, and swimmer delivery vehicles. The MK 6 Mod 1 MMS is a fielded fleet asset, operated by EODMU THREE, Naval Amphibious Base Coronado. The system was deployed to Vietnam in 1970–71 to protect the ammunition pier at Cam Ranh Bay, and to Bahrain in 1987–88 during Operation Earnest Will. The system is currently tasked in San Diego by the Commander, Navy Region Southwest. SSC San Diego is the life-cycle support activity and performs in-service engineering agent (ISEA), depot, and spares production functions.

MK 6 Mod 1 MMS can be operated in stand-alone mode, or for target reacquisition and marking in response mode following detection by other surveillance systems. Furthermore, the system can be operated as either a roving patrol or a sentry. During patrol operations, a small boat is used to transport personnel, equipment, and a dolphin to the operational site. The dolphin enters the water, and then follows the boat while searching the area, as directed by the trainer, using its biological sonar. If a target (swimmer/diver, swimmer delivery vehicle) is identified, the animal pushes a positive response paddle located on the side of the boat. The dolphin is then given marking hardware, and carries it to the target for marking (Figure 1). For sentry operations, the dolphin is transported to a temporary enclosure that serves as a sentry post. The trainer periodically directs the dolphin to search the vicinity of the post. Following detection and marking, other security assets further prosecute the targets while the dolphin operating team exits the area.

SHALLOW WATER INTRUDER DETECTION SYSTEM

The trainability and reliability of California sea lions has been demonstrated for nearly 30 years by the Navy's MK 5 Mod 1 MMS, which performs the mission of recovering exercise and training mines for the Fleet. California sea lions are very agile and adept at maneuvering in shallow and cluttered waters. They possess extremely good vision in low light and/or high-turbidity areas and excellent directional hearing. These characteristics make these animals uniquely capable in shallow water intruder detection. Biological systems are most useful in areas that cannot make use of fixed sensors because of the physical layout of the area to be protected. California sea lions are easily transported and can be quickly deployed. The capability of sea lions to locate, report, and mark swimmers and scuba divers was initially demonstrated in 1993 during tests at Naval Submarine Bases San Diego, CA, and New London, CT.

Tests of the SWIDS were sponsored by the Defense Nuclear Agency (DNA) in support of the Navy Operational Requirement #214-09-87, Waterside Security Systems (WSS). The capability demonstration was necessitated because WSS performance was degraded in areas around ships, piers, shorelines, and shallow water inlets. Despite a successful demonstration, this capability was never further developed, either as a new system or a product improvement to MK 5 Mod 1 MMS. However, SSC San Diego, which is the Navy Marine Mammal Life-Cycle Support Activity, and performs ISEA, depot, and spares production functions for the MK 5 Mod 1 MMS, maintains a demonstration capability of this potential asset. It can be operated for patrol or clearance in a stand-alone

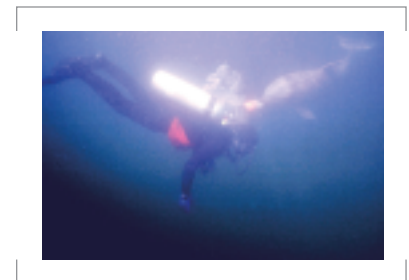


FIGURE 1. MK 6 dolphin marking a scuba diver in open water.

mode, or for target reacquisition and marking in the response mode following detection by other hardware systems or the MK 6 Mod 1 MMS. A small boat is used to transport personnel, equipment, and a sea lion to the operational site. The sea lion enters the water, and searches an area as directed by the trainer (Figure 2). If a target (swimmer/diver) is identified, the animal returns to the boat and pushes a positive response paddle. The sea lion is then given marking hardware and returns for attachment to the leg of the target. The marking hardware is designed to facilitate retrieval and interrogation of the target by other security assets. Other security assets further prosecute marked targets.

In more recent years, the system has drawn force protection interest from the submarine community for security at Trident facilities as well as National Aeronautics and Space Administration (NASA) for coastal protection support during space shuttle launches. SWIDS was most recently tasked with providing force protection and port security for naval assets operating in and around Bahrain.

SUBASE KINGS BAY MMS FORCE PROTECTION DEMONSTRATION

Following the 11 September 2001 terrorist attacks, the requirement to provide enhanced port security and force protection to naval assets has increased significantly. This includes threats from underwater attack. In response to this increased requirement, Office of the Chief of Naval Operations (OPNAV) N775 and Strategic Systems Programs (SSP) co-sponsored an MMS force protection demonstration at SUBASE Kings Bay, GA. The period of this demonstration was from 12 February 2002 to 4 March 2002. The goal of the demonstration was to exhibit the ability of the animals to perform port security duties at Kings Bay as well as investigate the interoperability of these systems to work alongside the existing SUBASE Kings Bay security assets. The deployed assets consisted of two MK 6 Mod 1 dolphins and three SWIDS sea lions along with the required support hardware and personnel. The demonstration was performed in two phases: Phase I focused on data gathering in independent operations; Phase II focused on integrated operations with the established Kings Bay security force structure. MK 6 was tasked to perform sentry and patrol duties, and SWIDS demonstrated patrol and response modes. The opposing force targets consisted of surface swimmers, scuba divers, and closed-circuit divers.

The results of the demonstration were very favorable and clearly demonstrated the ability of the animals to augment and enhance swimmer/diver detection and interdiction at SUBASE Kings Bay. In particular, the capability of the systems to classify targets as actual swimmers/divers and not some other biologic or other false positives is seen as an immediate improvement to the existing underwater detection systems. Additionally, in contrast to other underwater detection systems, the animals provide the added capability of positively responding to a detected underwater threat. Currently, efforts are underway to support an extended deployment of the systems to SUBASE Kings Bay to immediately enhance port security as well as further develop the concept of operations for employing these unique systems both at Kings Bay and other naval bases.



FIGURE 2. SWIDS searching for intruders in Bahrain.

CONCLUSION

The Navy's MMS are a proven asset in force protection and port security. These systems act as an immediate deterrent and can be operated independently or in concert with other security assets. The MK 6 MMS already exists as a fleet system and is currently tasked with performing real-world force protection duties. SWIDS is a demonstrated capability that has shown promising results through each phase of tasking and testing.



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